



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

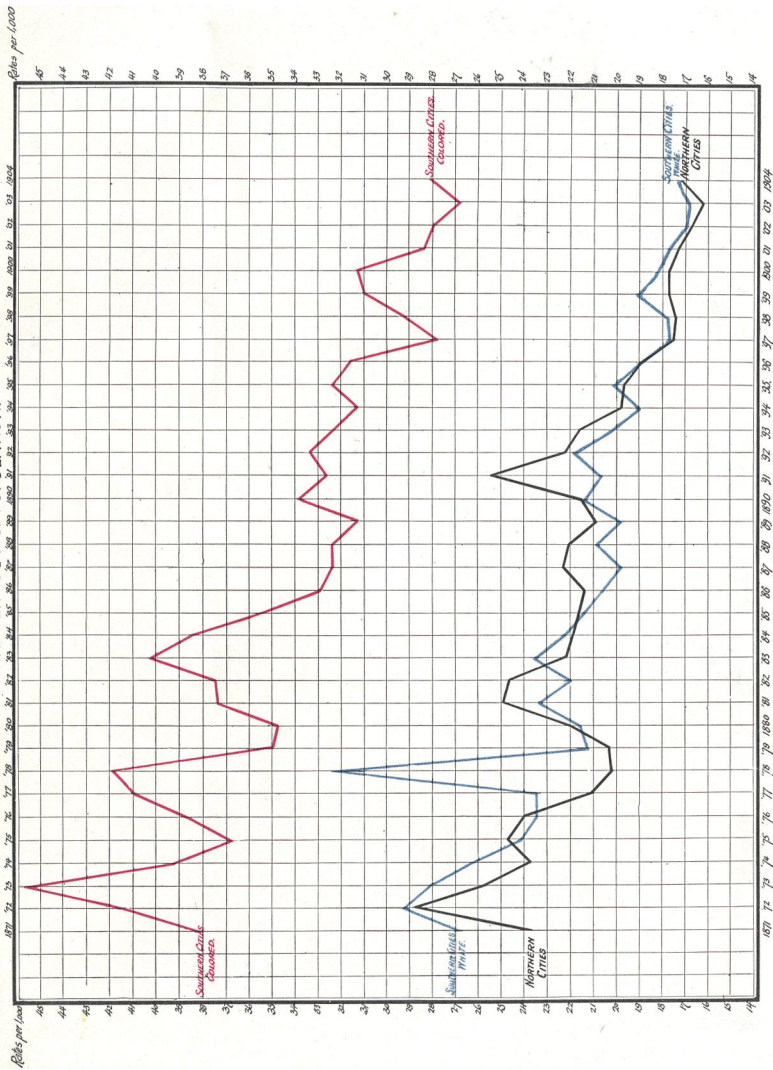
We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

The General Death Rate of American Cities - 1871 - 1904.

RATE PER 1000 OF POPULATION.



AMERICAN STATISTICAL ASSOCIATION.

NEW SERIES, No. 73.

MARCH, 1906.

THE GENERAL DEATH-RATE OF LARGE AMERICAN CITIES, 1871-1904.

BY FREDERICK L. HOFFMAN.

For a variety of purposes the general death-rate of cities is a necessary aid in the accurate determination of the conditions and tendencies of social life. The general death-rate, however, is so simple a *factor*, and so easily arrived at upon the basis of even very crude data, that few statistical standards of measurement have been more generally misused and perverted to false objects and purposes. The danger of misuse lies in the very simplicity of the calculation and in the great practical usefulness of the rate itself. Given an even approximate estimate of the population, or a fair guess as to the probable number of people in any given community, and any kind of an official return as to the number of deaths during a given year, the rate is easily calculated by any one familiar with elementary arithmetic. It has thus come about that the most erroneous ideas have gained currency, and that false views as to the comparative healthfulness or sanitary progress of states and cities, or of

the past and the present, have been widely disseminated, often upon the most slender basis of actual facts.

It is the purpose of this paper to point out some of the principal sources of error in the use of the general death-rate and the necessity for attention to the underlying elements of the problem. A further object is to point out the very limited value of the crude death-rate for the purpose of national or international comparisons to establish the relative healthfulness of different localities or their comparative sanitary progress. The present state of American vital statistics is not very far from deplorable. While an effort has been made in the direction of gathering the data for recent years through the medium of the Census Office,* which effort is certainly to be commended, and in conformity to a broad policy of national welfare, there is a still greater need of bringing together the vital records of the past, properly classified and arranged to establish with reasonable accuracy the true facts of our progress in public health, during at least the last thirty years. We also have nothing to compare, not even in the health reports of the cities of New York, Boston, Philadelphia, Chicago, and other large cities, with the thoroughly scientific and practically useful reports prepared by the medical officers of health of the large cities of England. A critical analysis of the mortality is, as a rule, wanting, and crude death-rates are used exclusively where specific death-rates are required. In not one of the reports of American cities are specific mortality rates calculated with due regard to sex, race, age, occupation, etc., and most sweeping conclusions are arrived at and recommendations are made upon the basis of the crude death-rate which by no means warrants such a procedure.

While the general death-rate is of very limited value for the purpose of comparison in the case of different localities,

*For a comprehensive review of the Census vital statistics, by the writer, see the *Publications of the American Statistical Association*, No. 60, Vol. VIII., 1902.

it is, I am satisfied, after a very careful investigation and much experience, of quite considerable value in making local comparison of the present health conditions with the past. If the comparison is limited to a reasonable period of years,—say, for illustration, two decades,—even a brief consideration of the elements of the population would easily establish whether there have been fundamental and important changes which would make such a comparison vicious or misleading. Nothing, however, is more likely to convince even the most sceptical of the practical value of the general death-rate as a means to establish the *tendency* towards better health conditions, and a lower rate of mortality, than to trace with patience and care the curves of death-rates for a large number of cities through a period of, say, thirty years. By this method it is clearly brought out that there is a considerable degree of similarity in the tendency of the death-rates of our different cities, however widely separated, and, when the average rate has been high, it has, as a rule, been high in the large majority of localities, and, when the average rate has been low, it has, as a rule, been low in most of the communities taken into account. It is, therefore, safe to hold that there must be underlying laws which, to a considerable extent, govern human health and mortality throughout the country, and the discovery of these laws is a public duty which emphasizes the need of a more scientific study of vital statistics, and in particular the relation of mortality to local causes favorable or unfavorable to longevity. It is nothing to our credit as a civilized nation that upon this question of national health we should have so meagre a basis of fact and so untrustworthy a basis or groundwork for social legislation as is at present the case. In the mean time the following data will serve a useful public purpose, and no doubt be found convenient by many to whom the original facts would be inaccessible.

The investigation includes all of the thirty-nine large cities

of the United States which by the last census had 100,000 or more inhabitants. For eighteen of these cities the mortality returns are complete for the years 1871-1904, and for the remainder the returns are for periods of variable length, but in each case I have included all the data which could be secured either from the official reports or by correspondence with the proper authorities. The returns have been consolidated into three tables respectively for Northern and Western cities, and for Southern cities, with distinction of color. The first of these tables includes thirty-four, while the two last are for five cities. It did not seem to me advisable to include the Southern cities with the Northern and Western cities, since the local conditions are quite different, and an average for the whole country would not be as useful and trustworthy for the particular problems under consideration.

Table A exhibits the population, mortality, and death-rate per 1,000 of Northern and Western cities. The table shows a persistent decline in the general death-rate from 23.7 in 1871 to 21.4 in 1886 and 17.2 in 1904. There are, of course, exceptions to this rule for individual years, but, taken one with another, the tendency is persistently downward. Commencing with the rate for 1871, the general death-rate at different times assumed an upward direction during eleven years, and a downward direction during twenty-two years, which it is safe to hold is fairly conclusive evidence of a distinct improvement in the health of a large majority of the cities represented in the consolidated mortality returns for the Northern and Western portions of the United States. This tendency is even more clearly illustrated in the diagram. The year of highest mortality for Northern and Western cities was 1872, while the year of lowest mortality was 1903.

TABLE A.
GENERAL DEATH-RATE OF AMERICAN CITIES, 1871-1904.

NORTHERN AND WESTERN CITIES.

Years.	Number of Cities.	Population.	Deaths.	Rate per 1,000 of Population.
1871	16	3,800,239	90,122	23.7
1872	16	3,922,805	112,731	28.7
1873	18	4,261,427	109,316	25.7
1874	19	4,430,486	104,845	23.7
1875	19	4,579,895	113,118	24.7
1876	19	4,714,563	112,929	24.0
1877	20	4,939,118	104,218	21.1
1878	21	5,232,406	105,695	20.2
1879	24	5,566,249	112,844	20.3
1880	24	5,735,326	126,141	22.0
1881	24	5,934,628	147,768	24.9
1882	24	6,143,634	151,135	24.6
1883	25	6,491,860	144,379	22.2
1884	26	6,805,848	148,874	21.9
1885	26	6,990,669	150,725	21.6
1886	27	7,415,416	158,343	21.4
1887	28	7,789,690	173,912	22.3
1888	28	8,112,079	178,610	22.0
1889	27	8,252,807	172,676	20.9
1890	31	9,121,273	196,076	21.5
1891	32	9,511,230	241,631	25.4
1892	32	9,790,201	217,210	22.2
1893	31	9,849,232	213,139	21.6
1894	30	10,072,401	199,493	19.8
1895	31	10,612,875	208,981	19.7
1896	31	10,922,957	205,933	18.9
1897	31	11,243,453	197,272	17.5
1898	31	11,574,782	200,851	17.4
1899	32	12,002,756	212,010	17.7
1900	33	12,476,986	220,989	17.7
1901	33	12,855,539	221,981	17.3
1902	33	13,247,099	221,246	16.7
1903	33	13,652,076	220,771	16.2
1904	33	14,071,828	241,437	17.2

Table B shows the consolidated mortality of the white population of Southern cities. For only two cities are the returns complete for the entire period of thirty-four years. The tendency of the rate has been persistently downward from 26.7 per 1,000 in 1871 to 20.6 in 1886 and 17.4 in 1904. Commencing with the rate for the year 1871, the general death-rate of the white population of Southern cities shows an upward direction at different times during twelve years,

and a downward direction during twenty-one years, following in this respect practically the same course as the corresponding death-rate for Northern and Western cities combined. The year of maximum mortality was 1878, due to a yellow fever epidemic, while the year of minimum mortality was, as in the case of the Northern and Western cities, 1903.

TABLE B.
GENERAL DEATH-RATE OF AMERICAN CITIES, 1871-1904.
SOUTHERN CITIES—WHITE POPULATION.

Years.	Number of Cities.	Population.	Deaths.	Rate per 1,000 of Population.
1871	2	357,071	9,533	26.7
1872	2	341,962	9,978	29.2
1873	2	388,029	10,853	28.0
1874	2	394,680	10,346	26.2
1875	2	401,446	9,660	24.1
1876	4	534,438	12,495	23.4
1877	4	587,680	13,748	23.4
1878	4	553,703	17,814	32.2
1879	4	564,677	11,972	21.2
1880	4	573,772	12,364	21.5
1881	4	587,907	13,716	23.3
1882	4	602,433	13,188	21.9
1883	4	618,281	14,557	23.5
1884	4	633,691	14,096	22.2
1885	4	649,560	13,925	21.4
1886	4	665,901	13,686	20.6
1887	4	682,733	13,484	19.8
1888	4	700,070	14,546	20.8
1889	4	717,934	14,230	19.8
1890	5	867,673	18,539	21.4
1891	5	884,322	18,293	20.7
1892	5	901,003	19,670	21.8
1893	5	918,022	18,509	20.2
1894	5	935,386	17,736	19.0
1895	5	953,103	19,141	20.1
1896	5	971,180	18,481	19.0
1897	5	989,627	17,540	17.7
1898	5	1,008,450	17,963	17.8
1899	5	1,027,659	19,582	19.1
1900	5	1,047,666	19,038	18.2
1901	5	1,067,741	19,057	17.8
1902	5	1,088,224	18,529	17.0
1903	5	1,108,778	18,688	16.9
1904	5	1,130,484	19,695	17.4

Table C exhibits the mortality of the colored population of Southern cities, corresponding to the mortality returns

for the white population. Without exception the death-rates are materially in excess of the corresponding death-rates of the white population, but there has also been in

TABLE C.

GENERAL DEATH-RATE OF AMERICAN CITIES, 1871-1904.

SOUTHERN CITIES—COLORED POPULATION.

Years.	Number of Cities.	Population.	Deaths.	Rate per 1,000 of Population.
1871	2	91,918	3,505	38.1
1872	2	86,861	3,582	41.2
1873	2	95,870	4,387	45.8
1874	2	97,920	3,853	39.3
1875	2	100,021	3,677	36.8
1876	4	169,795	6,579	38.7
1877	4	181,804	7,447	41.0
1878	4	177,586	7,434	41.9
1879	4	181,651	6,361	35.0
1880	4	185,825	6,459	34.8
1881	4	190,143	7,113	37.4
1882	4	194,562	7,304	37.5
1883	4	199,144	8,035	40.3
1884	4	203,875	7,839	38.5
1885	4	208,763	7,383	35.4
1886	4	213,815	7,042	32.9
1887	4	219,038	7,097	32.4
1888	4	224,442	7,278	32.4
1889	4	229,034	7,172	31.3
1890	5	264,524	8,966	33.9
1891	5	270,538	8,858	32.7
1892	5	276,732	9,243	33.4
1893	5	283,115	9,154	32.3
1894	5	289,694	9,062	31.3
1895	5	296,477	9,608	32.4
1896	5	303,471	9,580	31.6
1897	5	310,687	8,664	27.9
1898	5	318,133	9,302	29.2
1899	5	325,818	10,116	31.0
1900	5	333,764	10,461	31.3
1901	5	341,891	9,700	28.4
1902	5	350,272	9,811	28.0
1903	5	358,916	9,633	26.8
1904	5	367,838	10,328	28.1

this case a persistent decline in the general death-rate from 38.1 per 1,000 in 1871 to 32.9 in 1886 and 28.1 in 1904. Commencing with the rate for the year 1871, the general death-rate of the colored population of Southern cities at different times assumed an upward direction during fifteen

years and a downward direction during eighteen years, departing in this respect from the corresponding mortality of the white population of Southern cities and the general population of Northern and Western cities, the tendency of which was more distinctly towards a definite improvement. The year of maximum mortality for the colored population was 1873, while the year of minimum mortality was 1903.

The tables and diagram suggest the question as to whether the downward tendency in the American mortality rate is the result of a material improvement in the conditions of life or elements of locality, or is merely the mechanical resultant of fundamental changes in the elements of the population. These are broadly divided into permanent or unchangeable conditions of climate and physiographic features, such as latitude, longitude, altitude, etc. and the conditions of life proper, such as housing, drainage, sewerage, water supply, etc. Into the last group enter also personal habits, such as intemperance, diet, exercise, etc. The elements of the population proper, such as sex, age, race, and nativity distribution, are profoundly affected by a decline in the birth-rate, by migratory tendencies, from the country to the cities and *vice versa*, and perhaps most by the considerable influx of foreign immigrants, chiefly of ages 15 to 45. How far any one or all of these factors enter into the decline of the general death-rate is a most important problem, for the decline may be more apparent, if not entirely so, than a real decrease in the actual mortality and a consequent improvement in longevity. Again, the decrease in the mortality may be due entirely to a decline in the death-rate of certain large age groups, such as children under five years or young persons, ages 5 to 15, while there may have been at the same time a corresponding increase in the death-rate at more advanced ages. Therefore, to avoid misleading conclusions and erroneous interpretations of the decline in the general death-rate, it is necessary to examine with patience and care into the individual factors entering into the prob-

lem, but such an investigation is a most difficult one in the present state of our vital statistics. For the time being, this inquiry is limited to the general death-rate of individual cities, for which, in each case, the elements of population and locality are given in detail. Some time in the future I hope to extend this analysis to the principal causes of death and to the mortality at different periods of life, but for the present such an extensive investigation is out of the question.

In this investigation I have taken into account twenty distinct elements of locality and population. These are, in the order of their arrangement, size of city, density of population, latitude, longitude, elevation, rate of annual increase, proportion of males, proportion of foreign-born, proportion of foreign parentage, proportion of colored, proportion of illiterate, proportion of male wage-earners, proportion of ages under five years, ages 5 to 19, ages 20 to 64, ages 65 and over, ages unknown, mean annual maximum temperature, mean annual minimum temperature, and mean annual relative humidity. How far any or all of these factors affect human mortality is a question which can be determined only upon the basis of a thorough and critical analysis of all the available data bearing upon the subject.

The extremes in the variation of the elements of locality and population in the thirty-nine cities are as follows:—

RANGE OF ELEMENTS OF LOCALITY AND POPULATION.

Area	New Orleans, 125,600 acres	Allegheny, Pa., 4,639
Size	New York (Man. & Bronx), 2,050,600	Scranton, Pa., 102,026
Latitude	Minneapolis, 44.58° N.	New Orleans, 29.57° N.
Longitude	Boston, 71.4° W.	San Francisco, 121.24° W.
Elevation	Denver, 5,183 feet	New Orleans, 4.0 feet
Density	New York (Man. & Bronx), 50.9 persons per acre	New Orleans, 2.3 per- sons per acre
Annual Increase	Los Angeles, 10.3%	Cincinnati, 1.0%

Proportion of Males	St. Joseph, 55.0%	Washington, 47.4%
Proportion of Foreign-born	Fall River, 47.7%	Washington, 7.2%
Proportion of Foreign Parentage	Fall River, 86.1%	Washington, 20.9%
Proportion of Colored	Washington, 31.3%	Milwaukee, 0.3%
Proportion Illiterate	Fall River, 14.9%	Minneapolis, 1.8%
Proportion of Wage-earners	Pittsburg, 54.6%	St. Joseph, 12.3%
Ages, 0-5	Milwaukee, 12.3%	San Francisco, 7.6%
Ages, 5-9	Milwaukee, 32.6%	San Francisco, 23.4%
Ages, 20-64	San Francisco, 63.8%	Milwaukee, 51.6%
Ages, 64-	Syracuse, 4.5%	St. Joseph, 2.1%
Ages "Unknown"	Denver, 1.6%	Syracuse, 0.0%
Average Maximum Temperature	New Orleans, 76.1° F.	St. Paul, 53.0° F.
Average Minimum Temperature	New Orleans, 62.0° F.	St. Paul, 35.0° F.
Average Humidity	San Francisco, 79.9%	Denver, 48.7%
Average Death-rate per 1,000 (1900-04)	Pittsburg, 20.3	St. Joseph, 6.9

These extremes illustrate the serious difficulties of the problem and the practical certainty that conclusions which rest exclusively upon the general death-rate will be erroneous, particularly in the case of American cities. The conditions are such that even approximate truth is to be secured only by means of a critical analysis of the available data and a painstaking consideration of many facts and conditions which cannot be set forth in statistical tables.

There is a truly astonishing mass of material which has never been brought together in a convenient form, and which it is the proper function of the Federal Government to publish for general information and the advancement of the sciences of vital statistics and public health. There is an absence of uniformity in the age periods adopted, and also in the classification of the causes of death; but it would be possible under Government sanction to remedy many of the present shortcomings, if necessary, by an overhauling

of the original death certificates, which, of course in the large majority of instances, have been kept on file, and are available for that purpose. My own investigation is not sufficiently extensive in area to exhibit as clearly as would be desirable the intimate relation of mortality to any one or all of the twenty factors considered. The line had to be drawn somewhere, and by limiting the investigation to thirty-nine cities I had to exclude a large number of small cities, some of which have health records extending over long periods, and which, if included, would have thrown additional and valuable light upon the subject.*

In the present state of our vital statistics it is not possible to establish with more than approximate accuracy the probable relation of the various elements of locality and population to the general death-rate. The most important factor which enters into the problem is, without question, the age distribution of the population, which differs widely in different localities, and to a degree sufficient to lead to serious errors in a comparison of the general death-rate of certain communities with one another. As I have shown, the age constitution of the population of our large cities ranges, for illustration, from 32.6 per cent. of population at ages 5-19, in the case of Milwaukee, to 23.4 per cent. in the case of San Francisco. Since the specific death-rate at this period of life is only about 3.9 per 1,000, by the standard for the State of Massachusetts, it is readily apparent that

*I cannot at this time take up the subject of the probable defects and inaccuracies in the mortality returns of some of our cities, for which the published and official statements are without question understatements of the facts. There is a serious want of uniformity in the record of deaths; and certain cities even go so far as to exclude deaths from violence, suicide, and a number of other causes in the calculation of the local death-rate. Some cities exclude deaths of non-residents, which in certain cases form a very considerable item in the aggregate local mortality. Other cities merely report "officially" the local interments, and exclude the deaths of persons whose bodies were shipped for burial elsewhere. The matter is not only of local importance, but of national interest; and under the present organization and powers of the Census Office it would seem that an annual report on the mortality of the Registration Area of the United States should be made, with due regard to the elements of locality and population. The Federal Government alone has the power, the means, and the opportunity to deal with the subject in an adequate and satisfactory manner.

an excessive proportion of population at this age period must bring about a lowering of the general death-rate independent of local favorable or unfavorable health conditions; that is to say, a low general rate in the case of a city with a large proportion of population, ages 5-19, would probably be chiefly due to this fact, rather than to any particularly favorable health conditions of the locality.*

The specific death-rates at the four periods of life which I have considered in this investigation, by the standard for Massachusetts, are 52.6 per 1,000 at ages under 5, 3.9 at ages 5-19, 11.3 at ages 20-64, and 83.2 at ages 65 and over. If for the purpose of illustration we assume two localities, the one in which the population is distributed as follows: 6 per cent. at ages under 5, 34 per cent. at ages 5-19, 57 per cent. at ages 20-64, and 3 per cent. at ages 65 and over; and another locality in which the population is distributed as follows: 6 per cent. at ages under 5, 28 per cent. at ages 5-19, 57 per cent. at ages 20-64, and 9 per cent. at ages 65 and over; and, if upon the basis of this age distribution we apply the identical specific death-rates previously stated, we shall have in the case of the first-named city a general death-rate of 13.42 per 1,000 against 18.18 per 1,000 in the other, although in each case the specific mortality

* A striking illustration of the fallacy of such a comparison, upon the basis of the general death-rate, is the following for the cities of Fall River and San Francisco. The general death-rate of the former, by the census of 1900, was 22.4 per 1,000 against 20.5 for the latter, but, as a matter of fact, the specific death-rates were higher for San Francisco at all age periods except ages under five.

COMPARATIVE MORTALITY OF FALL RIVER AND SAN FRANCISCO,
CENSUS OF 1900.

	General Death-rate.	Specific Death-rate per 1,000 at each Age.						
		Under 5.	5-14.	15-24.	25-34.	35-44.	45-64.	65 and over.
Fall River . .	22.4	98.3	3.5	4.9	8.4	9.9	26.3	94.4
San Francisco	20.5	45.7	4.6	7.9	12.0	16.9	34.2	100.0
Deaths in Fall River to every 100 in San Francisco. . .	109	215	76	62	70	59	77	94

at each period of life is exactly the same. While I cannot very well at this time go further into the subject, I lay particular stress upon the seriously disturbing factor of the age distribution of the population and the necessity of taking this element into account in any comparison which may be made of the health conditions of one city with another and which can safely and finally be determined only upon the basis of specific death-rates for different periods of life, and not upon the general death-rate for the population as a whole.

As I have more than once pointed out, the present investigation is too limited in the number of cities considered to warrant final conclusions upon the actual effect of various local conditions and elements of population upon the general death-rate, but the various tables which follow afford a large amount of material for useful investigations, which, of course, can easily be extended by adding thereto the corresponding data for American cities with populations of less than 100,000. However, in a very general way, and rather as an introduction to the method which should be followed than as a final expression of opinion on possible laws of human mortality, I add to the preceding observations summary statements and observations, which on the whole will be found to correspond to generally accepted theories of vital statistics.

For the purpose of presenting in the form of a convenient summary some of the more general results of this investigation, I have in each of the twenty subdivisions of the elements of locality and population made a grouping of the cities into two divisions, representing respectively the two extremes of the group as a whole. While the division in some cases may appear arbitrary, it was difficult to adopt a more scientific grouping on account of the relatively small number of communities included in the investigation. In some cases also I did not succeed in obtaining all of the data of mortality or elements of locality and population, so that in

a few of the summary tables not all of the thirty-nine cities are included. The general death-rate is always for the five years 1900-04, and for the Southern cities only the white population has been considered, in order to eliminate errors resulting from the much higher general mortality of the negro population. The summary tables give the total populations and deaths for the five-year period and the corresponding death-rates are calculated from the facts given. Any other arrangement can be made without difficulty from the forty-four final tables.

The mere size of cities or aggregate population has, without question, a very definite relation to the general death-rate. In the following summary table each division is according to population above and below 300,000. The general death-rate of the first group was 17.8, and of the second group 15.7 per 1,000.

RELATION OF AGGREGATE POPULATION TO THE GENERAL DEATH-RATE, 1900-04.

Population.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000
300,000 and over . .	12	50,456,934	897,633	17.8
Under 300,000	27	22,113,787	346,379	15.7

The relation of the general death-rate to density of population is a well-established fact of vital statistics, and is referred to by nearly every writer upon the subject. In the case of American cities, however, exceptional care is necessary in order to avoid erroneous conclusions on account of the fact that in a number of cases the actual area of the city within the limits of incorporation does not correspond even approximately to the area of actual settlement. This, for illustration, is true of the cities of Greater New York and New Orleans, both of which have large areas which are practically as yet outside of actual settlement or are used for park purposes. To establish the fact of the relation of den-

sity to population with scientific accuracy, it would be necessary to adopt a smaller unit of area, such as wards or sanitary districts.*

In the following table I have adopted a broad division of thirteen cities with a density of fifteen or more persons to the acre, and of twenty-two cities with a density of less than fifteen persons per acre. Greater New York is not included in this table. The general death-rate for the group with the highest density was 18.3 per 1,000 against 15.5 for the group of cities with the lowest degree of density. The table, therefore, confirms the well-established doctrine that the general death-rate, other things equal, increases in proportion to increasing density of population.

RELATION OF DENSITY OF POPULATION TO THE GENERAL DEATH-RATE, 1900-04.

Density per Acre.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
15 persons and over .	16	41,858,895	767,187	18.3
Less than 15 persons .	23	30,711,826	476,825	15.5

The relation of geographical position to the general death-rate is a matter of very considerable importance. Unfortunately, for the present purpose the number of cities considered is not sufficiently large to warrant final conclusions with a more minute regard to difference, in location or even upon the broad division of cities North and South. To present this matter with scientific accuracy in a country of so vast an extent as the United States, it would be better to consider the two elements of latitude and longitude in conjunction with each other. As previously pointed out, the small number of cities considered in this investigation precludes such a division at the present time. I have di-

* An admirable attempt in this direction is the report of Dr. John S. Billings on the vital statistics of New York, Brooklyn, Boston, Philadelphia, District of Columbia, and Baltimore for the period 1885-90, in connection with the Eleventh Census.

vided the cities into two groups, respectively, north and south of the fortieth parallel, and it is shown in the table below that in the first group the general death-rate was 16.9 per 1,000 against 17.6 in the last. If a more minute division had been adopted, the differences in the general death-rate of Northern and Southern cities would have been brought out more clearly. Of course, for a more elaborate analysis the facts are made available by the tables for individual cities.

RELATION OF LATITUDE TO THE GENERAL DEATH-RATE, 1900-04.

Latitude (North).	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
Above 40 degrees . .	24	49,464,356	836,823	16.9
Below 40 degrees . . .	15	23,106,365	407,189	17.6

Considering the probable relation of geographical position according to longitude, it must not be overlooked that, speaking generally, as we proceed westward we are met by an increasing altitude, which, as will presently be shown, has a very considerable effect upon the general death-rate. In the table which follows I have divided the cities into two groups as they are located respectively east or west of the 80th meridian. The general death-rate in the group of seventeen Eastern cities was 18.5 per 1,000 against 15.5 for the group of twenty-two Western cities. A more elaborate

RELATION OF LONGITUDE TO THE GENERAL DEATH-RATE, 1900-04.

Longitude, (W of Greenwich.)	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
East of 80 degrees . .	17	39,557,551	730,954	18.5
West of 80 degrees . .	22	33,013,170	513,058	15.5

analysis of the facts, according to local physiographic features and conditions, such as, for illustration, location along the Great Lakes or in the Valley of the Mississippi

River, would have brought out various striking features, for which, of course, the data are made available through the tables in detail for the thirty-nine individual cities.

As previously pointed out, it is a well-established fact that, other things equal, the general death-rate decreases with increasing altitude except at extreme elevations. In the summary table exhibiting the general relation of altitude to the general death-rate I have drawn the line of division at 500 feet, and it is shown in the table which follows that the general death-rate of cities above the altitude of 500 feet was 14.4 per 1,000 against 18.7 for cities below an elevation of 500 feet above sea-level.

RELATION OF ALTITUDE TO THE GENERAL DEATH-RATE, 1900-04.

Altitude.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
Above 500 feet . . .	18	27,015,974	390,214	14.4
Below 500 feet	21	45,554,747	853,798	18.7

One of the most disturbing factors affecting the elements of population is the rate of annual increase,* which varies from almost a stationary population, in the case of Cincinnati, to as much as 10.3 per cent. in the case of the city of Los Angeles. It is reasonable to suppose that in cities with a rapidly increasing population, particularly where the increase is the result of immigration consisting principally of males, ages 15-45, the general death-rate would be low, independent of local favorable or unfavorable health conditions. In the table which follows I have arranged the cities according to the rate of annual increase in population, but the division is a very arbitrary one and a more complete analysis would be necessary for a final expression of opinion upon this point. The first group represents cities with an average annual rate of increase of more than 5 per cent., and for this group the general death-rate was

* The rate of increase is, according to the census of 1900, for the period 1890-1900.

14.0 per 1,000: the second group represents cities with an annual increase in population of less than 5 per cent., and for this group the general death-rate was 17.8 per 1,000.

RELATION OF ANNUAL INCREASE IN POPULATION TO THE GENERAL DEATH-RATE, 1900-04.

Annual Increase in Population.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
5 per cent., and over .	5	12,099,411	169,424	14.0
Under 5 per cent. . .	34	60,471,310	1,074,588	17.8

It is a well-established fact that, speaking generally, the mortality of males is higher than the corresponding mortality of females, but the difference in the mortality is, as a rule, obscured in the general death-rate on account of a more favorable age distribution of males resulting from immigration.* It is due to this fact that cities with a proportionately large number of males have, as a rule, a lower general death-rate than where the opposite condition exists, and this is brought out in the next table. Cities with a proportion of males of 50 per cent. and over show a general death-rate of 15.4 per 1,000, while those with a proportion of males of less than 50 per cent. show a general death-rate of 18.1 per 1,000. This condition, however, as I have pointed out, is not the result of sex distribution, but, in all probability, is due to the more favorable age distribution of males in certain cities in which the proportion of men is excessive.

The mortality of the foreign-born in the United States is unquestionably much higher than the corresponding mortality of the natives when the analysis is extended to

* COMPARATIVE MORTALITY OF MALES AND FEMALES (REGISTRATION RECORD), UNITED STATES CENSUS OF 1900 (RATES PER 1,000 OF POPULATION AT EACH AGE).

	All Ages.	Under 5.	5-14.	15-24.	25-34.	35-44.	45-64.	65 and over.
Males	19.0	56.7	4.4	6.7	9.5	12.4	24.1	91.1
Females . . .	16.6	47.5	4.2	6.1	8.5	10.5	20.1	82.6

RELATION OF PROPORTION OF MALE POPULATION TO THE GENERAL DEATH-RATE, 1900-04.

Proportion of Males.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
50 per cent. and over	15	25,054,048	385,624	15.4
Under 50 per cent. . .	24	47,516,673	858,388	18.1

different periods of life. In the summary table which follows the cities have been arranged according to the proportion of foreign-born, the first group having 30 per cent. or more of the foreign-born element and a general death-rate of 17.3 per 1,000, while the second group has less than 30 per cent. of foreign-born and a general death-rate of 17.0 per 1,000. It is necessary for me to add, however, that the term "foreign-born" is seriously misleading if the various nationalities are considered in the aggregate, for there are very wide differences in the mortality and disease liability of the different nationalities which have come to this country. Here, again, the age factor plays an important part, and representing, as the foreign-born do, chiefly male adults, ages 20-60, the factor of nationality is not so clearly exhibited in the general death-rate as would be the case if specific death-rates were calculated according to well-defined periods of life.†

RELATION OF PROPORTION OF FOREIGN-BORN TO THE GENERAL DEATH-RATE, 1900-04.

Proportion of Foreign-born.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
30 per cent. and over	13	39,993,902	691,789	17.3
Under 30 per cent. . .	26	32,576,819	552,223	17.0

† COMPARATIVE MORTALITY OF THE NATIVE AND FOREIGN BORN, REGISTRATION RECORD, CENSUS OF 1900 (RATES PER 1,000 POPULATION AT EACH AGE).

	AGES.				
	15-24.	25-34.	35-44.	45-64.	65 and over
Native-born whites	6.0	8.8	10.7	18.4	82.7
Foreign-born	5.6	8.2	11.6	25.8	90.3
Of foreign parentage . . .	6.1	10.4	12.6	18.8	87.6

Foreign parentage is another disturbing element in American vital statistics, and the conditions differ widely in various cities. In some cities the proportion of persons of foreign parentage—as, for illustration, in the case of Fall River, Mass.—is as high as 86 per cent. and as low as 20.9 per cent. in the case of Washington, D.C. There is another element which enters into the problem of foreign parentage in its relation to the general death-rate, and that is the higher fecundity of most of the foreign nativities as contrasted with the native element, and for this and other reasons the results of a general analysis are not conclusive.* The division in the following table is made between cities having 60 per cent. or more of the population of foreign parentage, of which the death-rate was 16.2 per 1,000, and cities having less than 60 per cent. of their population of foreign parentage, of which the death rate was 18.1.

RELATION OF PROPORTION OF FOREIGN PARENTAGE TO THE GENERAL DEATH-RATE, 1900-04.

Proportion of Foreign Parentage.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
60 per cent. and over .	22	36,960,643	600,010	16.2
Under 60 per cent. . .	17	35,610,078	644,002	18.1

Next to age there is probably no factor which so profoundly modifies the death-rate as race. As has been shown in the consolidated tables, the white death-rate of Southern cities for 1904 was 17.4 per 1,000 against a rate of 28.1 for

* COMPARATIVE MORTALITY BY BIRTHPLACE OF MOTHERS, REGISTRATION RECORD, U.S. CENSUS OF 1900 (RATES PER 1,000 POPULATION AT EACH AGE).

BIRTHPLACES OF MOTHERS.	AGES.				
	15-24.	25-34.	35-44.	45-64	65 and over.
United States	5.0	6.4	7.5	14.6	65.9
Ireland	7.5	12.2	15.0	30.6	96.9
Germany	4.8	7.4	9.6	20.3	81.8
England and Wales	4.6	6.6	8.8	18.3	81.1
Scandinavia	5.7	7.4	9.0	16.9	67.3

the colored element of the same cities. In other words, the general death-rate of the colored population at the present time is 61.5 per cent. in excess of the general death-rate of the white population of Southern cities. The effect of a large colored element is not clearly brought out in a general analysis of the facts regarding large American cities, due chiefly to the uneven distribution of this element, which is chiefly concentrated in the South. There can be no question, however,—and the view is sustained by the tables for individual cities,—that a large proportion of negroes is usually found to coincide with a higher death-rate. In the summary table I have found it necessary to adopt a rather arbitrary division, due to the facts previously stated; and the results are, therefore, inconclusive. The group of cities with a proportion of colored population of 5 per cent. and over shows a general death-rate of 17.3 per 1,000 against 17.1 for cities with a colored population of less than 5 per cent. If the line of division had been drawn at cities having 25 per cent. of colored population and over, of which in this inquiry, however, there are only three, the rate would have been 21.3 per 1,000.*

RELATION OF PROPORTION OF COLORED POPULATION TO THE GENERAL DEATH-RATE, 1900-04.

Proportion of Colored Population.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
5 per cent. and over . .	12	15,109,864	261,140	17.3
Under 5 per cent. . . .	27	57,460,857	982,872	17.1

* COMPARATIVE MORTALITY OF THE WHITE AND COLORED MALE POPULATIONS
REGISTRATION RECORD, U.S. CENSUS OF 1900 (RATES PER 1,000 POPULATION
AT EACH AGE).

	AGES.						
	Under 5.	5-14.	15-24.	25-34.	35-44.	45-64.	65 and over.
White males	54.2	4.2	6.2	9.0	12.0	23.5	90.4
Colored males	127.2	9.2	17.2	18.2	21.5	38.6	119.8
Deaths among colored males to every 100 among white males .	235	219	277	202	179	164	133

The relation of illiteracy to the general death-rate has not, as far as I am aware, been a subject of previous investigation. It is shown by the table which follows that cities with a proportion of illiteracy of 5 per cent. and more had a general death-rate of 19.5 per 1,000, while cities with a proportion of illiterates of less than 5 per cent. show a general death-rate of only 16.2 per 1,000.

RELATION OF PROPORTION OF ILLITERATE POPULATION TO THE GENERAL DEATH-RATE, 1900-04.

Proportion of Illiterates.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
5 per cent. and over .	10	21,080,224	411,124	19.5
Under 5 per cent. . .	29	51,490,497	832,888	16.2

The relation of occupation to health and mortality has been a subject of careful inquiry for many years, and this has been particularly the case in England, where the effect of manufactures upon the health and physique of the people employed in mechanical industries has received the attention of distinguished physicians and experts in statistics.* The general effect of manufacturing industries upon the general death-rate, however, is obscured by other factors, chiefly the peculiar age distribution of cities containing a large proportion of wage-earners employed in manufacturing establishments, so that a general inquiry into the subject fails to produce conclusive proof.† In the summary table showing the relation of the proportion of male wage-earners to the general death-rate, the rate for cities containing 30 per cent. or more of male wage-earners in proportion to the total male population, ages 15 and over, was 17.0 per 1,000 against 17.5 for cities with a proportion

* See in particular the annual reports of the Medical Officers of Health of Sheffield and Blackburn, England.

† I have discussed this subject at length in an address on "The Physical and Medical Aspects of Labor and Industry" before the Tenth Annual Meeting of the American Academy of Political and Social Science, Philadelphia, 1906.

of wage-earners below 30 per cent. In other words, the analysis is not sufficient to clearly establish the recognized injurious effects of indoor occupations generally or of employment in factories particularly, upon the general death-rate. To establish the true effect of manufacturing industries upon the health of the population, it is necessary to subject the data to a critical analysis and to consider individual industries with special reference to local conditions. There is probably no more important subject confronting health officers and others interested in the health and welfare of the wage-earning element of the population to-day than the unquestionably injurious effects resulting from long-continued employment in recognized ill-health-producing industries and hazardous employments. However, to avoid an erroneous interpretation of the summary table, I may add that, if the grouping had been limited to four cities which have a proportion of male wage-earners of 50 per cent. or more, the general death-rate would have been 19.4 per 1,000 against 17.4 for a group of six cities having a proportion of male wage-earners of less than 20 per cent.

RELATION OF PROPORTION OF MALE WAGE-EARNERS TO THE GENERAL DEATH-RATE, 1900-04.

Proportion of Male Wage-earners.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
30 per cent. and over .	24	52,809,053	899,145	17.0
Under 30 per cent. . .	15	19,761,668	344,867	17.5

As I have previously pointed out, the age distribution of the population is probably the most important factor affecting the general death-rate. In any comparison of one city with another in order to determine the local health conditions upon the basis of the general death-rate, it is necessary to ascertain first whether the age distribution of the population is at least approximately the same. In American cities the differences are very great, as illustrated in the extremes of Milwaukee and San Francisco, there being

in the former city 12.3 per cent. of the population at ages under 5 against 7.6 in the latter. Again, at ages 65 and over, the proportion of population is 4.5 per cent. for Syracuse, and only 2.1 per cent. for St. Joseph, Mo. These extremes illustrate the possibility of serious error in the use of the general death-rate, and emphasize the need of specific death-rates calculated for well-defined periods of life. In the summary table which follows I have divided the cities into two groups, having respectively a proportion of population at ages under five of 11 per cent. and over and of less than 11 per cent. The general death-rate in the first group was 17.3 per 1,000 against 16.9 in the second. Partly as the result of a diminishing birth-rate, but chiefly on account of the decreasing mortality of infants, a large proportion of children in the population of a city has not to-day the determining effect upon the general death-rate which it had in the past. The comparison, however, sustains the well-established principle that cities with a large proportion of children under 5 years will, other things equal, have a general death-rate above the average chiefly because of this fact, and not necessarily because of local unfavorable health conditions.

RELATION OF PROPORTION OF POPULATION OF AGES UNDER 5 YEARS TO
THE GENERAL DEATH-RATE, 1900-04.

Proportion of Ages under 5.	Number of Cities.	Total Popula- tion, 1900-04.	Total Mortal- ity, 1900-04.	General Death- rate per 1,000.
11 per cent. and over .	12	37,638,968	652,764	17.3
Under 11 per cent. . .	27	34,931,753	591,248	16.9

The next period of life—ages 5-19—has a very material effect upon the general death-rate, the more so in the case of American cities where the extremes are considerable, as, for illustration, in Milwaukee and San Francisco, being 32.6 per cent. in the former city against 23.4 per cent. in the latter. In the summary table I have made the division at cities having 29 per cent. or more of the population at

ages 5-19 and those with less than 29 per cent. The general death-rate in the first group was 15.4 per 1,000 against 18.3 in the second.

RELATION OF PROPORTION OF POPULATION OF AGES 5-19 TO THE GENERAL DEATH-RATE, 1900-04.

Proportion of Ages, 5-19.	Number of Cities.	Total Popula- tion, 1900-04.	Total Mortal- ity, 1900-04.	General Death- rate per 1,000.
29 per cent. and over .	15	28,064,321	431,004	15.4
Under 29 per cent. . .	24	44,506,400	813,008	18.3

While a large proportion of population at ages 5-19 is practically certain, other things equal, to reduce the general death-rate, a large proportion of the population of ages 20-64 is practically certain to increase the rate above the average. This is brought out by the next summary table, in which I have drawn the division at cities having 58 per cent. and over of the population at ages 20-64, inclusive, and cities having less than 58 per cent. of the population at this period of life. In the first group the general death-rate was 18.0 per 1,000 against 16.4 in the second.

RELATION OF PROPORTION OF POPULATION OF AGES 20-64 TO THE GENERAL DEATH-RATE, 1900-04.

Proportion of Ages, 20-64.	Number of Cities.	Total Popula- tion, 1900-04.	Total Mortal- ity, 1900-04.	General Death- rate per 1,000.
58 per cent. and over .	19	33,221,015	599,577	18.0
Under 58 per cent. . .	20	39,349,706	644,435	16.4

On account of the high death-rate in old age, which by the standard for Massachusetts is 83.2 per 1,000 for ages 65 and over,* an excessive proportion of old persons is practically certain, other things equal, to materially increase the general death-rate. This is best illustrated in the case of cities which have almshouses or soldiers' homes. In the summary table which follows I have divided the cities into two groups, having respectively 3.5 per cent. of the population of ages

* For the registration area of the United States the rate for 1900 was 86.6.

65 and over and cities having less than 3.5 per cent. While numerically the proportion of population is small, the actual number of deaths occurring at this period of life is very considerable, and materially disturbs the general death-rate where the proportion of old persons is very large. The general death-rate in the first group of cities with a high proportion of persons of advanced years was 18.0 per 1,000 against 16.7 in the second.

RELATION OF **PROPORTION OF POPULATION OF AGES 65 AND OVER TO THE GENERAL DEATH-RATE, 1900-04.**

Proportion of Ages, 65 and over.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
3.5 per cent. and over	15	23,370,299	421,373	18.0
Under 3.5 per cent. . .	24	49,200,422	822,639	16.7

I add a table of the cities arranged according to the proportion of persons whose ages were unknown. In the group of cities having less than 0.5 per cent. of population of ages which were not returned by the census, the general death-rate was 17.4 against 17.1 per 1,000 for cities having less than 0.5 per cent. of population of unknown ages.

RELATION OF **PROPORTION OF POPULATION OF AGES UNKNOWN TO THE GENERAL DEATH-RATE, 1900-04.**

Proportion of Ages Unknown.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
0.5 per cent. and over .	8	11,630,550	201,969	17.4
Under 0.5 per cent. . .	31	60,940,171	1,042,043	17.1

The relation of climate to health is a most important branch of medicine and vital statistics. It is not possible for me at this time to discuss details, partly because of the limitations of time and space and partly because the number of cities considered in this investigation is not sufficiently large to warrant final conclusions. There is probably no more profitable line of inquiry to be followed by students interested in the subject than the true relation of departures

from normal weather conditions to local health and mortality. The process of inquiry, however, is a very laborious one, since crude averages serve only a very limited and very often no practical purpose. To properly determine the relation of climate to mortality, it is necessary to consider the daily fluctuations in temperature, rain-fall, humidity, direction of winds, etc. Few Boards of Health return the mortality of a given locality by days, and the weekly returns are often not sufficient for the purpose of accurately determining the effect of local weather conditions upon local health and mortality.* In the three summary tables which follow I have limited myself, for the purpose of illustration, to the mean maximum annual temperature, the mean minimum annual temperature, and the mean per cent. of relative humidity. I have not been able to secure the necessary data for certain cities, and the comparison is therefore limited to only twenty-seven localities. In the summary table which follows the groups are divided into cities with a mean maximum temperature of 60 degrees and over and cities with a temperature below 60 degrees. In the former group, the general rate was 18.6 per 1,000 against 14.6 in the latter.

RELATION OF MEAN MAXIMUM TEMPERATURE TO THE GENERAL DEATH-RATE, 1900-04.

Temperature.	Number of Cities.	Total Population, 1900-04.	Total Mortality, 1900-04.	General Death-rate per 1,000.
60 degrees and over .	16	35,330,873	656,899	18.6
Under 60 degrees . .	11	23,249,691	338,743	14.6

The summary table showing the relation of mean minimum temperature to the general death-rate has been divided into eleven cities with a mean minimum temperature of 45 degrees and over and sixteen cities with a mean temperature of less than 45 degrees. In the former the general death-rate was 18.9 per 1,000 against 14.9 in the latter.

* As, for illustration, in the study of the mortality from suicide and sunstroke or the relation of weather to conduct and health.

RELATION OF MEAN MINIMUM TEMPERATURE TO THE GENERAL
DEATH-RATE, 1900-04.

Temperature.	Number of Cities.	Total Popula- tion, 1900-04.	Total Mortal- ity, 1900-04.	General Death- rate per 1,000.
45 degrees and over . .	11	30,683,839	579,512	18.9
Under 45 degrees . . .	16	27,896,725	416,130	14.9

The summary table showing the mean relative humidity in its relation to the general death-rate has been divided into two groups of cities having respectively a mean relative humidity of 70 per cent. and over and of less than 70 per cent. In the former group the general death-rate was 17.1 per 1,000 against 18.2 in the latter.* For a proper determination of the true effect of relative humidity to mortality it would be necessary to have a larger number of cities, and to eliminate the disturbing factor of increasing altitude. It is also advisable to take into consideration the dew point, which by some writers is held to be one of the most determining climatological factors in its effect upon the general death-rate.

RELATION OF MEAN RELATIVE HUMIDITY TO THE GENERAL DEATH-
RATE, 1900-04.

Humidity.	Number of Cities.	Total Popula- tion, 1900-04.	Total Mortal- ity, 1900-04.	General Death- rate per 1,000.
70 per cent. and over . .	19	47,648,260	814,127	17.1
Under 70 per cent. . . .	7	9,875,244	179,601	18.2

Summarizing these observations for the twenty elements of locality and population, it is brought out that there are certain striking differences in the general death-rate which apparently have no relation to local health conditions, such as water supplies, sewerage, sanitary administration, etc., but that they are rather the result of differences in the ele-

*If the comparison had been limited to two cities with a humidity above 76 per cent. and the comparison had been made with another group of cities having from 50 to 70 per cent. of humidity, the respective death-rates would have been 20 per 1,000 in the first group against 17 per 1,000 in the second.

ments of locality and population and not necessarily connected with local conditions determining normal health and long life. The summary tables illustrate the imperative necessity of extreme caution in the use of the general death-rate, and the limitation, as a rule, of the rate to local purposes to illustrate and determine the upward or downward direction of the death-rate of any given locality. In this, as in other problems of life the best results will follow from a careful study of local conditions, and, generally speaking, a disregard of conditions as they prevail in other communities with which any given locality may not be comparable or may differ in respect to elements over which the population may have no control. In other words, the value of the general death-rate is *specifically local*, and for this object it is shown, in the large majority of the cities reported upon in detail, to be of specific and determining value. What the people of any given city are chiefly interested in is to know whether the local death-rate is increasing or decreasing as compared with the returns for previous years or the past decade or generation, and they are only incidentally interested in conditions as they prevail elsewhere, and which for all practical purposes may afford no useful means of comparison.

The forty-four tables which follow will afford a convenient summary of the general facts of the elements of population and locality, and the general death-rate of the thirty-nine principal cities of the United States. The population for intercensal years has been estimated by the geometrical method, but in some cases it may be advisable to use the arithmetical method for the years subsequent to 1900. The tables, as far as I know, have never heretofore been published, and it is hoped that they may prove useful to those interested in the development of the sciences of vital statistics and public health.